DOCUMENT RESUME

ED 248 013 PS 014 482

AUTHOR Muller, Alexandra A.; Perlmutter, Marion
TITLE Preschool Children's Problem-Solving Interactions at Computers and Jigsaw Puzzles.
PUB DATE 10 Jan 84
NOTE 30p.; Document contains faint, broken print.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Age Differences; Communication (Thought Transfer); Comparative Analysis; *Cooperation; *Microcomputers; *Peer Relationship; *Preschool Children; Preschool Education; *Problem Solving; *Puzzles
IDENTIFIERS Context Effect; Sharing Behavior; *Social Interaction

ABSTRACT

In two studies, preschool children's social interactions while working on problem-solving tasks were investigated. In the first study, 27 preschool children were observed over a period of 9 weeks while working on learning games at a computer. Sharing, verbal and nonverbal instruction, and initiation of interaction were recorded. A total of 63 percent of the time at the computer was spent with a peer, and peers often spontaneously shared and instructed each other. Age-related increases in time spent at the computer, as well as in self-initiation of interaction and sharing, were evident. No differences were found in boys' and girls' activities at the computer. In the second study, 18 children were observed over a period of 5 weeks while working with jigsaw puzzles. In this context, children worked with peers just 7 percent of the time and exhibited far fewer instances of cooperative interaction. Generally, results indicated that preschool children can engage in cooperative problem solving and instruction and that various activities differentially stimulate such behavior. Further, in contrast to stereotypes about computers, this research suggested that even children younger than school age can work effectively at computers and that computer technology may actually stimulate social interaction in problem solving. (Author/RH)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED248013

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

X This document has been reproduced as received from the person or organization originating it.

[ ] Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

Preschool Children's Problem-Solving Interactions At Computers and Jigsaw Puzzles

Alexandra A. Muller

Center for Research in Human Learning

and

Marion Perlmutter

Institute of Child Development

University of Minnesota

PS 014482

Running head: Preschool Children's Problem-Solving Interactions

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Alexandria Muller

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Date submitted:
January 10, 1984

FILMED FROM
BEST COPY AVAILABLE

Abstract

Preschool children's social interactions while working on problem-solving tasks were investigated. In Study I, twenty-seven preschool children were observed working on learning games at a computer for 9 weeks. Sharing, verbal and nonverbal instruction, and initiation of interaction were recorded. Sixty-three percent of their time at the computer was spent with a peer, and they often spontaneously shared and instructed each other. Age-related increases in time spent at the computer, as well as in self-initiation of interaction and sharing were evident. No differences were found between boys' and girls' activities at the computer. In Study II, eighteen children were observed while working with jigsaw puzzles for 5 weeks. In this context, children worked with peers just 7% of the time, and exhibited far fewer instances of cooperative interaction. The results of this research indicate that preschool children can engage in cooperative problem-solving and instruction, and that various activities differentially stimulate such behavior. Further, in contrast to stereotypes about computers, this research suggests that even children younger than school age can work effectively at computers.and that this technology may actually stimulate social interaction in the aid of problem-solving.

PRESCHOOL CHILDREN'S PROBLEM-SOLVING INTERACTIONS AT COMPUTERS AND JIGSAW PUZZLES

The present research was designed to explore the way preschool children interact with peers when problem-solving. Several theoretical perspectives suggest that experience in joint problem-solving may be influential in children's cognitive growth. For example, a number of investigators (Levin & Kareev 1980; Vygotsky 1978; Wertch 1980) have suggested that the ability to direct one's problem-solving efforts stems from the child's interactions with adults and other children. Researchers working in the Piagetian tradition have suggested that conflict of opinion among peers may induce disequilibrium and encourage cognitive development (Murray, 1972; Perret-Clermont, 1980).

Research in the area of peer tutoring suggests that elementary school children can effectively teach other children under specifically designed conditions (Allen, 1976; Cazden, Cox Dickinson, Steinberg & Stone, 1979; Cicirelli, 1976; Johnson & Johnson, 1975; Steward & Steward, 1974). Some research also shows that school-age children can function in a collaborative, rather than didactic partnership. In problem-solving tasks children have been found to offer opinions, hypotheses, and special expertise (Beaudichon, 1981; Cooper, 1980; Perret-Clermont, 1980). However, studies of peer interaction on complex laboratory classification tasks suggest that even school-age child teachers sometimes are unable to provide effective instruction (Ellis & Rogoff, 1982; Steward & Steward, 1974). They rely more on demonstration of tasks than adults, often do

not allow adequate participation by a partner, and frequently require questioning by the learners to provide instructions (Ellis & Rogoff, 1982; Cooper, Ayers-Lopez & Marquis, 1982; Steward & Steward, 1974). It still is not known how regularly or effectively problem-solving interaction takes place in the everyday lives of grade-school children, nor the degree to which such cooperative problem-solving interaction is possible for younger children.

In considering peer interaction as a possible forum for early acquisition of cognitive skills, young children's limited communication skills must be considered. Although some studies have shown that preschool children are capable of adapting their communication to the needs of listeners (eg. de Villiers & de Villiers 1974; Maratsos 1973; Menig-Peterson 1975; Shatz & Gelman 1973), other studies have indicated the opposite (eg. Fishbein & Osborn 1971; Flavell, Botkin, Fry, Wright & Jarvis 1968; Glucksberg, Krauss & Weisberg 1966; Krauss & Glucksberg 1969; for a review see Glucksberg, Krauss & Higgins 1975). Such contradictory findings suggest that the information processing demands and ecological validity of the task probably play a role in children's ability to communicate meaningfully with others (Flavell 1977, Beaudichon, 1981). It will be essential, therefore, to determine whether young children are able to apply their communicative competencies in domains of specific interest.

Two such domains that were investigated in the present research are problem-solving at a computer and at jigsaw puzzles. The computer was chosen because it is a naturalistic problem-

solving situation that is becoming ubiquitous in children's lives; raising concerns about its impact on interpersonal interaction. Puzzles, a common children's activity, were chosen as a contrasting context. Both contexts allow, although do not require, joint problem-solving activity. The degree of isolated versus interactive activity was examined, as was the nature of children's interactions. In particular, observations were made of the amount of task participation partners allowed one another, the relative amounts of verbal and nonverbal instructions, and the degree to which the instructions were spontaneously offered versus requested.

STUDY I

The first study focused on preschool children's interactions in the context of problem-solving with computers. Thus far, there has been little research investigating how computers are used in classrooms, particularly preschool classrooms. Moreover, research on children's computer use has rarely considered the social interaction it may promote. While it is popularly held that computers are socially isolating, some evidence suggests that computers stimulate interaction and collaboration. For example, Hawkins, Sheingold, Gearhart, and Berger (1982) observed more interaction when 8 to 11-year-olds worked on a computer, than when they worked on non-computer classroom tasks. Levin and Kareev (1980) found the computer to be a naturalistic context which provided a rich environment for observing collaborative problem-solving interaction in 10-year-olds. Apparently computers do provide opportunities for peer interaction, collaboration, and

teaching.

Given the increasing prevalence of computers, it is essential that the developmental level at which children can begin to profit from interaction with this technology not be underestimated. The issue of how young children can or should be formally exposed to computers is important, because it is possible that those who are exposed to computers early will be most comfortable and facile with them later.

Method

Subjects

The subjects in Study I were 27 children (13 males and 14 females) attending the University of Minnesota Child Care Center. Their mean age was 4 years, 4 months (range; 3 years, 8 months to 5 years, 7 months). The average Peabody Picture Vocabulary Test score of the 22 children for whom it was available was 116 (range: 92 to 160). This mean is approximately one standard deviation above the general population mean.

Background Measures

Children's preschool friendships were assessed by teacher ratings. Each of three teachers was independently shown an alphabetized list of the names of the children participating in the study. The teacher was asked to indicate the children that each of the subjects tended to play with most. Children were designated as friends if two or more teachers reported them as consistent playmates. On the average, each child was rated as having 2 friends from the sample of 27 (range: 0 - 4).

A questionnaire designed for the study asked parents to indicate whether their child had prior exposure to computers, and

their children's curiosity concerning new objects, activities, adults, and children. Sixteen questionnaires were returned. Three mothers and 3 fathers used a computer at their job. Only two children were reported as having had some exposure to computers, based on the questionnaire data and teacher reports.

Apparatus and Stimulus Material

An Apple II computer with 48K of memory, a single disk drive, and a standard keyboard was available in the children's classroom. The software used was a commercially produced diskette purchased from the Minnesota Educational Computing Consortium. There were two alphabet games, a game on identifying the initial letter of a pictured word, three counting games, and three concentration-type memory matching games using pictures, words, or shapes. In order to choose a program the child had only to press a number corresponding to a picture which depicted the program they wanted. To respond to a program, a child needed only to press a single letter or number.

Procedure

Introduction to Computer. The children were introduced to the computer and programs by a teacher in groups of about 10. In one half-hour introductory session they received verbal explanation as well as hands-on experience.

Use of Computer. The children's behavior with the computer was observed over 9 weeks in each of three 1 and 1/2 hour free-play sessions per week. During these times, the children were allowed to work at the computer alone or with one other child. The children decided with whom they worked at the computer, as

well as how long they remained at it. Since other activities were also available, this procedure usually allowed several groups the opportunity to use the computer during the 90 minute session.

Setting for Computer. The computer was placed in a central location against one wall of the preschool classroom, and turned on with the program directory visible on the screen. This free access was designed to convey to the children that the computer was something to be readily approached and used. The teachers were asked to interact with the children at the computer in the same manner and to the same extent as they did when the children were engaged in other classroom activities. Teachers in this child care center usually let the children play independently, unless their help or company was actively sought or seemed to be needed by a child. This same pattern was followed by the teachers when children were at the computer.

Recording of Behavior at Computer. Observers coded each child's arrival and departure from the computer, the amount of time spent there, and social interaction. As may be seen in Table 1, three categories were used to describe the composition of social interaction (i.e. the presence of partners). These were none, teacher, and peer. Three categories were also used to describe the initiation of social interaction. These were self-initiated, teacher-requested, and peer-requested. In addition, there were four categories to describe the form of interaction. These were sharing (turn-taking), doing (performing the action for another), showing (demonstrating the action), and explaining (describing the action). Finally, comments were recorded on any

other noteworthy behavior, such as, aggression. This coding scheme was derived from one reported by Bar-Tal, Raviv, and Goldberg (1982). Inter-observer reliability was calculated on approximately one-half of the observations. The observers were considered to have reached agreement when the initiation and form of an interaction were categorized identically by each observer. Agreement was calculated by dividing the number of agreements by the total number of behaviors recorded. The average inter-observer agreement for all categories was 96%, with a range of 88 - 99% for the various categories.

Insert Table 1 about here

Results and Discussion

Overall, 203 episodes of child-computer activity were observed. All children interacted with the computer at least once. The range in number of interactions per child was 1 to 25, and the mean was 8. The average length of time of each episode was 13 minutes. For the most part, children seemed to prefer working at the computer with another individual, especially a peer. As shown in Table 2, 63% percent of the time children were at the computer they worked with a peer, 26% of the time they were with a teacher, and only 11% of the time were they alone. Approximately 18% of the peer contacts were between children rated as friends.

Insert Table 2 about here

When children worked at the computer with a peer, they typically were actively interacting and cooperating. For example, as can be seen in Table 3, 70% of the peer interactions consisted of actively sharing use of the computer by taking turns. The remaining 30% of these interactions consisted of nonverbal and verbal assistance.

Insert Table 3 about here

Most of these helping interactions were initiated by the children themselves, rather than requested by teachers or peers. Specifically, as Table 4 shows, 78% of the peer interactions were self-initiated, 19% were initiated by a peer, and only 3% were initiated as a result of a request by a teacher.

Insert Table 4 about here

In order to determine whether there were age differences in the pattern of behavior, t-tests were performed to compare the data from the lower and upper thirds of the age range. The average age of the younger children was 3 years, 10 months (n=13), and the average age of the older children was 5 years, 1 month (n=14). For the sake of convenience, the groups will be referred to as 4- and 5-year-olds.

Age differences between 4- and 5-year-olds emerged in a

number of areas. Table 5 shows 5-year-olds spent more time at the computer overall than did 4-year-olds ($t=-2.00$, $p< .10$). This difference can be accounted for by the increase in time at the computer spent with peers ($t=-2.27$, $p< .05$). The amount of time 4- and 5-year-olds spent alone, or with teachers, did not differ between the two ages.

Insert Table 5 about here

In addition, as may be seen in Table 6, 5-year-olds displayed significantly more turn-taking or sharing at the computer than did 4-year-olds ($t=-2.07$, $p< .05$).

Insert Table 6 about here

As may be seen in Table 7, five-year-olds were also significantly more likely to be the initiators of sharing or instructing than were 4-year-olds ($t=-2.29$, $p< .05$).

Insert Table 7 about here

In order to determine whether there were gender differences in the pattern of behavior, t-tests were performed to compare the data for boys and girls. No significant differences between girls and boys were found on any of the measures. Likewise, no differences emerged as a function of PPVT score or parent curiosity rating.

It appears that preschool children can work at a computer, and prefer working with another child to working alone. Children not only seemed to prefer the presence of another child, but they were found to share use of the computer and were able to help each other in using it through demonstration and verbal explanations. Furthermore, most of this cooperative behavior was self-initiated. It is also noteworthy that there was a substantial amount of cooperative interaction despite the fact that only about one-fifth of the peer interactions were between children rated as friends.

In summary, the presence of a computer seemed to provide a focus for social interaction among preschool children. The children were found to provide considerable help and instruction for each other with minimal intervention from a teacher. The fact that such helping was common supports the idea that computers may create an ideal context for social interaction which contributes to the acquisition of problem-solving skills.

STUDY II

In the second study, preschool children's social interactions when working at jigsaw puzzles was examined. The data from this study provides evidence concerning whether the social interaction around the computer was different in quantity or quality than interactions in the context of at least one other common intellectual task.

Method

Subjects

The subjects in Study II, were a subset of the children who participated in Study I. They were children from the original

group who remained in school for the summer session. There was a total of 18 children (8 males and 10 females). Their mean age was 4 years, 4 months (range: 3 years, 5 months to 5 years, 1 month). Their mean score on the PPVT was 117 (range: 92 to 160).

Stimulus Material

The materials the children worked with were four new wooden jigsaw puzzles. Each puzzle represented one of the four seasons: summer, fall, winter, spring. Each contained approximately 27 pieces, and had been advertised as appropriately challenging for 4- and 5-year-olds.

Procedure

Use of Puzzles. The children's behavior with the puzzles and each other was observed over 5 weeks, in each of three, 1 1/2 hour free-play sessions per week. The children were allowed to work with the puzzles alone or in groups of two. They were also allowed to decide on their own how long they worked at the puzzles. Teachers let the children work independently, unless their help or company was actively sought or seemed to be needed by a child. Thus, in a number of potentially important ways, the procedure matched the procedure used with the computer.

Setting for the Puzzles. The setting for the puzzles also was made as similar to the setting for the computer as possible. The four puzzles were available to the children, but only one was to be used at a time. A single intact puzzle was placed on a table, against a wall in a central location in the children's classroom. Upon completing one puzzle a child could choose another to replace it. This puzzle activity was freely available

in the classroom during playtime, along with the other activities usually available. The computer was not present in the classroom during the time that observations of puzzles were carried out. Conversely, these puzzles had not been available during the computer observations.

Recording of Behavior at Puzzles. Observers coded each child's arrival and departure from the puzzle area, the amount of time spent with each puzzle, and social interaction. The coding scheme used in this study was the same as in Study I (see Table 1).

Results and Discussion

Overall, 49 episodes of child-puzzle activity were observed. All children interacted with the puzzles at least once. The range in number of interactions was 1 to 8 and the mean was 3. The average length of time of each episode was 10 minutes.

The pattern of behavior with the puzzles was quite different than had been observed at the computer. First, as can be seen in Table 2, the percentage of time children spent alone at the puzzles was substantially greater than the percentage of time they had spent alone at the computer, 55% and 11% respectively. Children worked with a peer at the puzzles only a very small percentage of the time, 7% in contrast to 63% at the computer. Of this small percentage of peer interactions at the puzzles, none were between children rated as friends. Furthermore, as Table 3 indicates, unlike at the computer, there was no turn-taking at the puzzles. Most of the children's interaction took the form of verbal explanations, which accounted for 64% of interactions. Finally, as Table 4 shows, interactions at the

puzzles were rarely self-initiated by children, and seemed more often to be only in response to a direct question.

General Discussion

Most past research concerning children's peer interactions and communicative skills has been performed under laboratory conditions with specially designed tasks. This research has involved work groups, time, and goals that have been severely constrained by the experimenter. The present studies were carried out in a preschool classroom in which primarily natural constraints were operative. Research in this setting should be especially useful in advancing understanding of young children's social and cognitive skills, as well as in determining the training or incentives that will be needed to introduce and promote computers and other activities in the classroom.

Across the two studies, there was a discrepancy in preschool peers' interaction while involved in problem-solving tasks. In Study I, there was considerable evidence of sharing or give and take at the computer, as well as some evidence of explaining and nonverbal assistance. In Study II, there was little evidence of social interaction during puzzle activity. These findings suggest that the cooperative behaviors observed in the computer setting may be, to some extent, a function of the computer and are not necessarily common or appropriate in all problem-solving situations that young children encounter.

A number of factors might account for greater interaction at computers than at puzzles. First of all, the novelty of the computer may have played a role in the greater interaction.

Although all children had at least some prior exposure to the computer in their classroom, its novelty may have sparked a level of interest that will wane over time. Second, working at the computer was more open to view than working on puzzles. The computer screen was relatively large and upright, easily seen from around the room. Therefore, the visibility of computer activity may have drawn children to it. A third possible factor contributing to the high incidence of social interaction at the computer is that there was only one computer. Children may have been more constrained to work together than if several had been available. However, this possibility seems less likely than might be expected, since the computer was not in use at all times when it was available. Finally, the nature of the computer task and its information processing demands may have stimulated social problem-solving, whereas the nature of puzzle-solving activity may have limited it. The computer tasks used in the present study did not depend very much upon what had gone before, whereas puzzle-solving probably requires a more wholistic strategy.

The research reported here suggests that computers may stimulate children's tendency to work together. The findings indicate that even preschool age children can use a computer with a standard keyboard if the software provided is age-appropriate and the context is adequately structured. In addition, the presence of a computer in the classroom does not necessarily spawn a classroom of computer hackers who ignore peers and teacher for the computer. Children seemed to enjoy working together at the computer. They appeared to seek each other's companionship, allowed partners significant participation through

sharing, and provided verbal and non-verbal instruction for each other.

The research also uncovered several interesting developmental differences in social interaction at the computer. With age, children spent more time working with peers, engaged in more sharing, and were more likely to self-initiate help. The implication of these findings is that even at preschool age children are able to interact effectively in a problem-solving situation. Furthermore, the computer context allows, and perhaps enhances, expression of such interactive skills, although even in this context age factors seem to contribute to increased sociability.

Although it has been suggested that boys are more likely to get involved with computers than are girls, this tendency was not apparent in the present preschool age sample. Anecdotal reports from teachers and others (Benderson, 1983) suggest that by the elementary school years, boys are making greater use of computers than girls. Although the finding of a lack of gender difference in preschool children's use of a computer should be replicated, it suggests that the early years may be an excellent time to introduce computers in order to promote equal comfort with this technology for girls and boys.

In summary, the results of the present research indicate that the common view of computer-human interaction as a solitary activity should be questioned. Computers actually may provide a rich opportunity for social interaction and cognitive skill acquisition, even in very young children.

References

Allen, V. L. (1976). Children as teachers: Theory and research on tutoring. New York: Academic Press.

Bar-Tal, D., Raviv, A. & Goldberg, M. (1982). Helping behavior among preschool children: An observational study. Child Development, 53, 396-402.

Beaudichon, J. (1981). Problem-solving, communication and complex information transmission in groups. In W. P. Dickinson (Ed.), Children's oral communication skills. New York: Academic Press.

Benderson, A. (1983). Computer literacy. Focus, 11, 17-24. Educational Testing Service Research Report.

Cazden, C. B., Cox, M., Dickinson, D., Steinberg, Z., & Stone, C. (1979). "You all gonna hafta listen": Peer teaching in a primary classroom. In W. A. Collins (Ed.), Children's language and communication: The Minnesota symposia on child psychology (vol. 12). Hillsdale, NJ: Erlbaum.

Cicirelli, V. G. (1976). Siblings teach siblings. In V. L. Allen (Ed.), Children as teachers: Theory and research on tutoring. New York: Academic Press.

Cooper, C. R. (1980). Collaboration in children: Dyadic interaction skills in problem-solving. Developmental Psychology, 16, 433-440.

Cooper, C., Ayres-Lopez, S., & Marquis, A. (1982). Peer

learning in the classroom: Tracing developmental patterns and consequences in children's spontaneous interactions. In L. C. Wilkinson (Ed.), Communication in the classroom. New York: Academic Press.

de Villiers, P. A. & de Villiers, J. G. (1974). On this, that, and the other: Nonegocentrism in very young children. Journal of Experimental Child Psychology, 18, 438-447.

Ellis, S., & Rogoff, B. (1982). The strategies and efficacy of child vs. adult teachers. Child Development, 53, 730-735.

Fishbein, H. D. & Osborne, M. (1971). The effects of feedback variations on referential communication of children. Merrill-Palmer Quarterly, 17, 243-250.

Flavell, J. H. (1977). Cognitive development. Englewood Cliffs, NJ: Prentice-Hall, Inc.

Flavell, H. J., Botkin, P. T., Fry, C. L., Wright, J. C., & Jarvis, P. E. (1968). The Development of Role-Taking and Communication Skills in Children. New York: Wiley.

Glucksberg, S., Krauss, R. M., & Higgins, E. T. (1975). The development of referential communication skills. In F. D. Horowitz (Ed.), Review of Child Development Research. Vol. 4. Chicago: University of Chicago Press.

Glucksberg S. Krauss, R. M., & Weisberg, R. (1966). Referential communication in nursery school children: Method and some preliminary findings. Journal of Experimental Child Psychology,

3, 333-342.

Hawkins, J., Sheingold, K., Gearhart, M. & Berger, C. (1982). Microcomputers in Schools: Impact on the Social Life of Elementary Classrooms. Journal of Applied Developmental Psychology, 3, 361-373.

Johnson, D. W. & Johnson, R. T. (1975). Learning Together and Alone. Englewood Cliffs, N.J.: Prentice-Hall.

Krauss, R. M. & Glucksberg, S. (1969). The development of communication: Competence as a function of age. Child Development, 40, 255-256.

Levin, J. & Kareev, Y. (1980). Problem-solving in everyday situations. The Quarterly Newsletter of the Laboratory of Comparative Human Cognition, 2. 47-51.

Maratsos, M. P. (1973). Nonegocentric communication abilities in preschool children. Child Development, 44, 697-700.

Menig-Peterson, C. L. (1975). The modification of communicative behavior in preschool-aged children as a function of the listener's perspective. Child Development, 46, 1015-1018.

Murray, F. B. (1972). Acquisition of conservation through social interaction. Developmental Psychology, 6, 1-6.

Perret-Clermont, A. N. (1980). Social interaction and cognitive development in children. London: Academic Press.

Shatz, M. & Gelman, R. (1973). The development of communication

skills; Modifications in the speech of young children as a function of listener. Monographs of the Society for Research in Child Development, 38 (5, Serial No. 152).

Steward, M., & Steward, D. (1974). Parents and siblings as teachers. In E. J. Mash, L. C. Handy, & L. A. Hamerlynck (Eds.), Behavior modification approaches to parenting. New York: Brunner/Mazel Publishers.

Vygotsky, L. S. (1978). Mind in Society. Cambridge, Mass.: Harvard University Press.

Wertsch, J. V., McNamee, G. D., McLane, J. B., & Burdwig, N. A. (1980). The adult-child dyad as a problem-solving system. Child Development, 51, 1215-1221.

Footnote

This research was supported by grants 1ROS HDMH11776 and 5R13 HD10650. Alexandra Muller was supported by the Center for Research in Human Learning while the probject was carried out. The authors would like to thank Edward DeAngelo and Sonja Hernandez for their contribution in data collection. They also are greatful for the enthusiasm and assistance of the former director of the University of Minnesota Child Care Center, Steven Sternberg, and the current director, teachers, students, and parents. Thanks to Bill Stixrud and Shirley Moore for providing PPVT scores. Requests for reprints should be sent to Marion Perlmutter, Institute of Child Development, 51 East River Road, University of Minnesota, Minneapolis, MN 55455.

TABLE 1

CODING CATEGORIES

Category	Definition
<u>Composition</u> of Interaction	
None	No other present
Teacher	Teacher present
Peer	Peer present
<u>Initiation</u> of Interaction	
Self	Not preceded by request
Teacher	Preceded by teacher request
Peer	Preceded by peer request
<u>Form</u> of Interaction	
Sharing	Turn taking
Doing	Performing required action for another child
Showing	Demonstrating required action for another child
Explaining	Telling another child the the required action

TABLE 2

MEAN PERCENTAGE OF TIME SPENT ALONE, WITH TEACHER, AND WITH PEER WHILE AT THE COMPUTER OR PUZZLES

	Computer	Puzzles
Alone	11%	55%
With Teacher	26%	38%
With Peer	63%	7%

TABLE 3

MEAN PERCENTAGE OF EACH TYPE OF PEER INTERACTION AT THE COMPUTER AND PUZZLES

	Computer	Puzzles
Sharing	70%	0%
Doing	10%	8%
Showing	9%	28%
Explaining	11%	64%

TABLE 4

MEAN PERCENTAGE OF INTERACTION INITIATIONS AT THE COMPUTER AND PUZZLES

	Computer	Puzzles
Self-initiated	78%	50%
Teacher-initiated	3%	0%
Peer-initiated	19%	50%

TABLE 5

MEAN TIME IN MINUTES SPENT ALONE, WITH TEACHER AND WITH PEER AT THE COMPUTER

	4-yr-olds	5-yr-olds	t-value
Total	71.5	143.5	-2.00 +
Alone	6.1	8.8	NS
With Teacher	18.2	19.5	NS
With Peer	47.3	115.3	-2.27 *

+ $p < .10$
* $p < .05$

TABLE 6

MEAN FREQUENCY OF EACH TYPE OF PEER INTERACTION AT THE COMPUTER AS A FUNCTION OF AGE

	4-yr-olds	5-yr-olds	t-value
Total	30.0	50.4	NS
Sharing	12.1	29.6	-2.07 *
Doing	2.9	8.6	NS
Showing	9.4	5.1	NS
Explaining	5.6	7.2	NS

* p < .05

TABLE 7

MEAN FREQUENCY OF INITIATIONS AT THE COMPUTER AS A FUNCTION OF AGE

	4-yr-olds	5-yr-olds	t-value
Self-initiated	11.8	36.6	-2.29 *
Teacher-initiated	0.6	0.5	NS
Peer-initiated	4.7	4.9	NS

* $p < .05$